



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**DEPARTMENT OF PURE AND APPLIED SCIENCES**

**2020\_2 EXAMINATIONS...**

**COURSE CODE:** CHM 309

**CREDIT UNIT:** 3

**COURSE TITLE:** Applied Spectroscopy

**TIME:** 3 HRS

**INSTRUCTION:** Answer question 1 and any other 4 questions

**QUESTION 1**

- (a) Discuss the following factors that affect the absorption of radiation in the UV/visible region
- (i) Solvent Effects (**4 marks**)
  - (ii) Substituent Effects (**4 marks**)
- (b) Explain the concept of molecular ion in mass spectroscopy (**4 marks**)
- (c) Explain three (3) factors that determine the intensity and energy level of absorption in IR spectroscopy (**3 marks**)
- (d) Discuss the concept of chemical ionization in mass spectrometry (**4 marks**)
- (e) Explain the term chemical shift in Nuclear magnetic Resonance (NMR) spectroscopy (**3 marks**)

**Question 2**

- (a) Discuss the theoretical basis of Nuclear Magnetic Resonance (**7 marks**)
- (b) Explain the spinning Nuclear of hydrogen atom (**3 marks**)
- (c) State the universally accepted reference used in the chemical shift measurement. (**2 marks**).

**Question 3**

- (a) Discuss the kinds of transitions exhibited by electrons in a molecule in the UV – visible spectra. (**7 marks**)
- (b) Explain the anti-bonding orbitals in a molecule in the UV – visible spectra. (**5 marks**)

**Question 4**

- (a) Show the relationship between absorbance and concentration of the sample as stated in Beer – Lambert law. (**9 marks**)
- (b) Explain the relationship between energy of photon and the wavelength. (**3 marks**)

**Question 5**

- (a) Explain positive ion chemical ionization (PICI) as one of the ionization techniques used in GC-MS. (**4.5 Marks**).

(b) State the application of LC-MS in drug metabolic studies. **(5 marks)**

(c) state the relationship between the magnetic moment, energy, and frequency. **(2.5 marks)**

**Question 6**

(a) State the five main components of a typical NMR spectrometer **(7.5 marks)**

(b) Explain the principles behind thermospray as one of the interfaces used in LC-MS **(4.5 marks)**